

### REMARKS/ARGUMENTS

In the Office Action mailed October 28, 2003, claims 1 and 4-21 were examined. The amendment filed with the U.S. Patent and Trademark Office ("USPTO") on September 9, 2003 was objected to under 35 U.S.C. § 132, as allegedly introducing new matter into the disclosure. Claims 1 and 4-21 were rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement. Claims 1, 4, 6-10, and 13-21 were rejected under 35 U.S.C. § 102(b), as allegedly anticipated by, or, in the alternative, under 35 U.S.C. § 103(a), as allegedly obvious over, U.S. Patent No. 5,948,862 to Sano et al. ("the Sano patent"). Also, claims 1, 4-11, and 13-21 were rejected under 35 U.S.C. § 102(e), as allegedly anticipated by, or, in the alternative, under 35 U.S.C. § 103(a), as allegedly obvious over, U.S. Patent No. 6,359,065 to Yabuki ("the Yabuki patent"). In addition, claims 1, 5-12, and 15-21 were rejected under 35 U.S.C. § 102(b), as allegedly anticipated by, or, in the alternative, under 35 U.S.C. § 103(a), as allegedly obvious over, U.S. Patent No. 5,717,014 to Ohkawachi et al. ("the Ohkawachi patent"). Furthermore, claims 1, 5-7, 9-12, and 15-21 were rejected under obviousness-type double patenting, as being allegedly unpatentable over claims 10 and 28 of U.S. Patent No. 6,508,725 to Kim ("the Kim patent").

Applicant respectfully traverses the rejections of the claims, for the reasons set forth below.

#### The Invention

Before addressing the specific claim rejections, it will be helpful first to briefly summarize the invention of the pending claims.

The invention is embodied in a golf ball component selected from the group consisting of a cover and an intermediate layer located between a golf ball core and a cover, the golf ball component incorporating a particular triblock copolymer, a base polymer, and a polymeric modifier. The triblock copolymer has a first polymer block comprising an aromatic vinyl compound. The triblock copolymer also includes a second polymer block, which includes a first compound selected from the group consisting of a diene compound and a hydrogenation product of the diene compound. In addition, the triblock copolymer includes a third polymer

block including a second compound selected from the group consisting of a diene compound, a hydrogenation product of the diene compound, and an aromatic vinyl compound. Furthermore, the triblock copolymer includes at least one hydroxyl group. The polymeric modifier is selected from the group consisting of an impact modifier, a functionalized polymer, or a mixture of these. The impact modifier is selected from the group consisting of methyl methacrylate butylacrylate styrene, methyl methacrylate ethyl hexylacrylate styrene, methacrylate-butadiene-styrene, ethylene vinyl acetate, acrylonitrile-butadiene-styrene, and chlorinated polyethylene. The functionalized polymer incorporates a copolymer or a terpolymer having a glycidyl group, hydroxyl group, maleic anhydride group or carboxylic group, or a mixture of these copolymers and terpolymers.

The base polymer can incorporate an ionomeric polymer comprising copolymeric polymers, terpolymeric polymers, or mixtures of these. The base polymer also can incorporate a non-ionomeric polymer. The ratio by weight of the triblock copolymer to the base polymer in the golf ball component preferably ranges between about 10:90 and about 90:10, more preferably between about 10:90 and about 70:30, and most preferably between about 10:90 and about 60:40.

When incorporating the impact modifier, the golf ball component incorporates the impact modifier in an amount between about 0.1 and about 15 parts per hundred by weight of the total amount of the triblock copolymer and the base polymer, and more preferably between about 1 and about 10 parts per hundred. Particularly preferred impact modifiers include acrylic impact modifier, ethylene vinyl acetate, polyaryl ether, acrylonitrile-butadiene-styrene, methacrylate-butadiene-styrene, chlorinated polyethylene, or mixtures of these. Particularly preferred acrylic impact modifier includes methyl methacrylate butylacrylate styrene, methyl methacrylate ethyl hexylacrylate styrene, or mixtures of these. When incorporating the functionalized polymer, the golf ball component preferably incorporates the functionalized polymer in an amount between about 0.1 and about 15 parts per hundred by weight of the total amount of the triblock copolymer and the base polymer, more preferably between about 1 and about 10 parts per hundred. The golf ball component preferably incorporates a total amount of polymeric modifier less than about

20 parts per hundred by weight of the total amount of the triblock copolymer and the base polymer, and more preferably less than about 15 parts per hundred.

Golf ball components within the scope of the present invention also can incorporate UV stabilizers, photostabilizers, photoinitiators, co-initiators, antioxidants, colorants, dispersants, mold releasing agents, processing aids, inorganic fillers, organic fillers, or mixtures thereof.

The invention also resides in a method for making a golf ball component selected from the group consisting of a cover and an intermediate layer located between a golf ball core and a cover, the method including preparing a composition comprising the above-specified triblock copolymer, a base polymer, and a polymeric modifier as defined above, and then incorporating the composition into the golf ball component. The step of preparing the composition can incorporate dry-blending the composition, or it can incorporate mixing the composition using a mill, internal mixer, or extruder. The step of mixing the composition also can incorporate melting the composition.

**The Objection to the Amendment Filed With The USPTO on September 9, 2003 Under 35 U.S.C. § 132**

On page 2 of the Office Action, the amendment filed on September 9, 2003 was objected to under 35 U.S.C. § 132, as allegedly introducing new matter into the disclosure. In particular, the Examiner stated the following:

The added material, which is not supported by the original disclosure, is as follows: The amendment calls for the compositions to be used as a core component. The applicant failed to point out basis on [sic] the original specification for support. Applicant is required to cancel the new matter in the reply to his Office Action.

Applicant has amended the specification and claims to remove references to the golf ball component composition being used as part of a core component. Accordingly, Applicant respectfully request withdrawal of the objection to the amendment filed on September 9, 2003.

**The Rejection of Claims 1 and 4-21 Under 35 U.S.C. § 112, First Paragraph**

On page 2 of the Office Action, claims 1 and 4-21 were rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement. In particular, the Examiner stated the following:

Claims 1 and 18 call for the composition to be used [sic] a core component. Applicant has failed to point out basis in the original specification for support. Claims 1 and 18 call for the "end group" of the copolymer to be a [sic] certain structures. Applicant has failed to point out basis in the original specification for support.

Applicant respectfully traverses this rejection.

Applicant has amended independent claims 1 and 18 to remove the word "core" from the claimed golf ball components. The words "end group" included in independent claims 1 and 18 are known to those of ordinary skill in the polymer chemistry art, as evidenced in the enclosed copy of an excerpt from the book entitled "Polymer Chemistry An Introduction," by Malcolm P. Stevens, Oxford University Press, 3<sup>rd</sup> Edition, pages 6 and 7 (1999). Applicant has canceled dependent claims 11 and 12, and, thus the Examiner's rejections to those claims are moot. Accordingly, Applicant believes that remaining claims 1, 4-10, and 13-21 comply with § 112, first paragraph, and respectfully request withdrawal of this ground of rejection.

**The Rejection of Claims 1, 4, 6-10, and 13-21 Based on the Sano Patent**

On page 3 of the Office Action, independent claims 1 and 18, and dependent claims 4, 6-10, 13-17, and 19-21, were rejected under 35 U.S.C. § 102(b), as allegedly anticipated by, or, in the alternative, under 35 U.S.C. § 103(a), as allegedly obvious over, the Sano patent. Applicant respectfully traverses these rejections.

The Sano patent discloses a golf ball having a core, one or more intermediate layers, and a cover. The intermediate layer is formed of a heated mixture including at least two of the following: an inomer resin, a thermoplastic elastomer having terminal OH groups, and an

epoxy group. The epoxy group includes styrene-butadiene-styrene block copolymer or styrene-isoprene-styrene block copolymer.

Regarding the Sano patent, the Examiner on page 3 of the Office Action stated the following:

Sano exemplifies (Table 2) compositions for intermediate layers of golf balls. The composition contains ionomer (applicant's base), HG-252 (applicant's hydroxylated block polymer) and epoxidized block polymer. The epoxidized block polymer qualifies as an impact modifier because it affects durability (column 4, line 3). It also qualifies as a functional copolymer.

The Examiner's reliance on the Sano patent is misplaced. Applicant submits that the Sano patent fails to teach or suggest "a polymeric modifier selected from the group consisting of: (i) an impact modifier selected from the group consisting of methyl methacrylate butylacrylate styrene, methyl methacrylate ethyl hexylacrylate styrene, methacrylate-butadiene-styrene, ethylene vinyl acetate, acrylonitrile-butadiene-styrene, and chlorinated polyethylene, (ii) a functionalized polymer selected from the group consisting of a copolymer and a terpolymer wherein the copolymer includes an end group selected from the group consisting of a glycidyl group, a hydroxyl group, a maleic anhydride group, and a carboxylic group, and the terpolymer includes an end group selected from the group consisting of a glycidyl group, a hydroxyl group, a maleic anhydride group, and a carboxylic group, and (iii) mixtures of the impact modifier and the functionalized polymer," as required by amended independent claims 1 and 18.

More specifically, the epoxidized block polymer (see column 3, lines 31-45) taught in the Sano patent is not one of the impact modifier materials or functionalized polymer materials included in independent claims 1 and 18. Furthermore, it would not have been obvious to one skilled in the art to modify the teachings of the Sano patent to satisfy the requirements of independent claims 1 and 18. For these reasons, the § 102 rejection and the alternative § 103 rejection of independent claims 1 and 18, and dependent claims 4, 6-10, 13-17, and 19-21, are improper and should be withdrawn.

**The Rejection of Claims 1, 4-11, and 13-21 Based on the Yabuki Patent**

On page 3 of the Office Action, independent claims 1 and 18, and dependent claims 4-11, 13-17, and 19-21, were rejected under 35 U.S.C. § 102(e), as allegedly anticipated by, or, in the alternative, under 35 U.S.C. § 103(a), as allegedly obvious over, the Yabuki patent. Applicant has canceled dependent claim 11, and, thus the Examiner's rejection of that claim is moot. Applicant respectfully traverses these rejections of remaining claims 1, 4-10, and 13-21.

The Yabuki patent teaches a golf ball having a solid core and a cover formed from a heated mixture of: an ionomer resin, a thermoplastic elastomer having a carboxyl group or a terminal OH group, and a block copolymer. The block copolymer has a styrene-butadiene-styrene structure or a styrene-isoprene-styrene structure.

Regarding the Yabuki patent, the Examiner on page 3 of the Office Action stated the following: "Yabuki exemplifies (No. 7) blends of ionomer, HG-252, Himilan 1855 and epoxidized block polymer. Either of the Himilan 1855 and epoxidized block polymer can qualify as applicant's base polymer." The Examiner's reliance on the Yabuki patent is misplaced. Applicant submits that the Yabuki patent fails to teach or suggest "a polymeric modifier selected from the group consisting of: (i) an impact modifier selected from the group consisting of methyl methacrylate butylacrylate styrene, methyl methacrylate ethyl hexylacrylate styrene, methacrylate-butadiene-styrene, ethylene vinyl acetate, acrylonitrile-butadiene-styrene, and chlorinated polyethylene, (ii) a functionalized polymer selected from the group consisting of a copolymer and a terpolymer wherein the copolymer includes an end group selected from the group consisting of a glycidyl group, a hydroxyl group, a maleic anhydride group, and a carboxylic group, and the terpolymer includes an end group selected from the group consisting of a glycidyl group, a hydroxyl group, a maleic anhydride group, and a carboxylic group, and (iii) mixtures of the impact modifier and the functionalized polymer," as required by amended independent claims 1 and 18.

More specifically, neither the Himilan 1855 (see column 10, line 66, to column 11, line 3), nor the epoxidized block polymer (see column 5, line 16, to column 6, line 9), taught

in the Yabuki patent is one of the impact modifier materials or functional polymer materials included in independent claims 1 and 18. Furthermore, it would not have been obvious to one skilled in the art to modify the teachings of the Yabuki patent to satisfy the requirements of independent claims 1 and 18. For these reasons, the § 102 rejection and the alternative § 103 rejection of independent claims 1 and 18, and dependent claims 4-10, 13-17, and 19-21, are improper and should be withdrawn.

**The Rejection of Claims 1, 5-12, and 15-21 Based on the Ohkawachi Patent**

On page 3 of the Office Action, independent claims 1 and 18, and dependent claims 5-12, 15-17, and 19-21, were rejected under 35 U.S.C. § 102(b), as allegedly anticipated by, or, in the alternative, under 35 U.S.C. § 103(a), as allegedly obvious over, the Ohkawachi patent. Applicant has canceled dependent claims 11 and 12, and, thus the Examiner's rejection of these claims is moot. Applicant respectfully traverses these rejections of remaining claims 1, 5-10, and 15-21.

The Ohkawachi patent, as stated in column 2, lines 23 to 35, teaches the following:

a PPE [polyphenylene ether] resin composition containing the following Components (A) to (D) at the following formulation ratio.

(A) 50 to 99.5 parts by weight PPE

(B) 0.5 to 50 parts by weight of a partially hydrogenated aromatic alkenyl compound-conjugated diene block copolymer having a hydroxy group based on the total amount of Components (A) and (B) being 100 parts by weight.

(C) 0 to 950 parts by weight of a thermoplastic resin other than the above (A) and (B) and

(D) 0 to 10 parts by weight of a phosphorous acid triester.

Regarding the Ohkawachi patent, the Examiner on page 3 of the Office Action stated the following: "Ohkawachi exemplifies (No. 4) a blend of PPE (applicant's polyarylether impact modifier) HG-252 (applicant's block polymer) and PBT(applicant's base polymer)." The Examiner's reliance on the Ohkawachi patent is misplaced. Applicant submits that the

Ohkawachi patent fails to teach or suggest "a polymeric modifier selected from the group consisting of: (i) an impact modifier selected from the group consisting of methyl methacrylate butylacrylate styrene, methyl methacrylate ethyl hexylacrylate styrene, methacrylate-butadiene-styrene, ethylene vinyl acetate, acrylonitrile-butadiene-styrene, and chlorinated polyethylene, (ii) a functionalized polymer selected from the group consisting of a copolymer and a terpolymer wherein the copolymer includes an end group selected from the group consisting of a glycidyl group, a hydroxyl group, a maleic anhydride group, and a carboxylic group, and the terpolymer includes an end group selected from the group consisting of a glycidyl group, a hydroxyl group, a maleic anhydride group, and a carboxylic group, and (iii) mixtures of the impact modifier and the functionalized polymer," as required by amended independent claims 1 and 18.

More specifically, the PPE taught in the Ohkawachi patent is not one of the impact modifier materials or functionalized polymer materials included in independent claims 1 and 18. Furthermore, it would not have been obvious to one skilled in the art to modify the teachings of the Ohkawachi patent to satisfy the requirements of independent claims 1 and 18. For these reasons, the § 102 rejection and the alternative § 103 rejection of independent claims 1 and 18, and dependent claims 5-10, 15-17, and 19-21, are improper and should be withdrawn.

**The Rejection of Claims 1, 5-7, 9-12, and 15-21 Under Obviousness-Type Double Patenting**

On page 4 of the Office Action, independent claims 1 and 18, and dependent claims 5-7, 9-12, 15-17, and 19-21, were rejected under obviousness-type double patenting as being allegedly unpatentable over claims 10 and 28 of the Kim patent. Applicant has canceled dependent claims 11 and 12, and, thus, the Examiner's rejection of those claims is moot. Applicant respectfully traverses this rejection of remaining claims 1, 5-7, 9-10, and 15-21.

Regarding the Kim patent, the Examiner on page 4 of the Office Action stated the following:

Although the conflicting claims [of the Kim patent] are not identical, they are not patentably distinct from each other because the patent claims golf ball materials of polyamide, PPE and a



hydroxylated styrene/diene block polymer. The polyamide qualifies as applicant's base and PPE qualifies as applicant's impact modifier.

The Examiner's reliance on the Kim patent is misplaced. Applicant submits that the polyamide/polyphenylether ("PPE") alloy taught in claims 10 and 28 of the Kim patent are patentably distinct from the "a polymeric modifier selected from the group consisting of: (i) an impact modifier selected from the group consisting of methyl methacrylate butylacrylate styrene, methyl methacrylate ethyl hexylacrylate styrene, methacrylate-butadiene-styrene, ethylene vinyl acetate, acrylonitrile-butadiene-styrene, and chlorinated polyethylene, (ii) a functionalized polymer selected from the group consisting of a copolymer and a terpolymer wherein the copolymer includes an end group selected from the group consisting of a glycidyl group, a hydroxyl group, a maleic anhydride group, and a carboxylic group, and the terpolymer includes an end group selected from the group consisting of a glycidyl group, a hydroxyl group, a maleic anhydride group, and a carboxylic group, and (iii) mixtures of the impact modifier and the functionalized polymer," as required by amended independent claims 1 and 18.

More specifically, the claims of the Kim patent are patentably distinct from the requirements of independent claims 1 and 18, because the PPE disclosed in claims 10 and 28 of the Kim patent is not one of the impact modifier materials or functionalized polymer materials included in independent claims 1 and 18. Furthermore, claims 10 and 28 of the Kim patent are patentably distinct from independent claims 1 and 18 in the present application, because it would not have been obvious to one skilled in the art to modify claims 10 and 28 of the Kim patent to satisfy the requirements of independent claims 1 and 18. For these reasons, the obviousness-type double patenting rejection of independent claims 1 and 18, and dependent claims 5-7, 9-10, 15-17, and 19-21, is improper and should be withdrawn.

### Conclusion

This application should now be in condition for a favorable action. Allowance of the application is respectfully requested. If for any reason the Examiner finds the application other than in allowance, the Examiner is requested to call the undersigned attorney at the below-indicated telephone number to discuss the steps necessary for placing the application in condition

for allowance. Applicant also respectfully requests that should the Examiner find the application other than in allowance, the amendments proposed herein to be entered for purposes of Appeal. If there are any fees due in connection with the filing of this Amendment, please charge the fees to our Deposit Account No. 19-1853.

Respectfully submitted,  
SHEPPARD, MULLIN, RICHTER & HAMPTON LLP

By: 

Brian D. Martin  
Registration No. 47,771

333 South Hope Street, 48th Floor  
Los Angeles, California 90071  
(213) 620-1780

T H I R D   E D I T I O N

# POLYMER CHEMISTRY

AN INTRODUCTION

Malcolm P. Stevens

University of Hartford

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the theories of Staudinger on a firm experimental basis and led to the commercial development of neoprene rubber and polyamide (nylon) fibers.<sup>11</sup>

World War II led to significant advances in polymer chemistry, particularly with the development of synthetic rubber when the natural rubber-growing regions of the Far East became inaccessible to the Allies. Among the more significant developments of the postwar years was the discovery by Karl Ziegler<sup>12</sup> in Germany of new coordination catalysts for initiating polymerization reactions and the application by Giulio Natta in Italy of these new systems to development of polymers having controlled stereochemistry.<sup>13</sup> Their work has revolutionized the polymer industry, for these so-called stereoregular polymers have mechanical properties superior in most instances to those of nonstereoregular polymers. The importance of their discoveries was recognized by the award of the Nobel Prize in Chemistry jointly to Ziegler and Natta in 1963. Equally significant was the work of Paul Flory<sup>14</sup> (Nobel Prize 1974), who established a quantitative basis for polymer behavior, whether it be the physical properties of macromolecules in solution or in bulk or such chemical phenomena as crosslinking and chain transfer (concepts to be encountered later in this text).

More recent years have seen a number of important advances in polymer science, which will be elaborated on in this and later chapters. Examples include:

Polymers having excellent thermal and oxidative stability, for use in high-performance aerospace applications

Engineering plastics—polymers designed to replace metals

High-strength aromatic fibers, some based on liquid crystal technology, for use in a variety of applications from tire cord to cables for anchoring oceanic oil-drilling platforms

Nonflammable polymers, including some that emit a minimum of smoke or toxic fumes

Degradable polymers, which not only help reduce the volume of unsightly plastics waste but also allow controlled release of drugs or agricultural chemicals

Polymers for a broad spectrum of medical applications, from degradable sutures to artificial organs

Conducting polymers—polymers that exhibit electrical conductivities comparable to those of metals

Polymers that serve as insoluble supports for catalysts or for automated protein or nucleic acid synthesis (Bruce Merrifield, who originated solid-phase protein synthesis, was awarded the Nobel Prize in Chemistry in 1984)

This list, by no means exhaustive, clearly illustrates that polymer chemistry is an exciting field with almost limitless possibilities.

## 1.2 Definitions

As already mentioned, the term *polymer* refers to large molecules—macromolecules—whose structure depends on the monomer or monomers used in their preparation. If only a few monomer units are joined together, the resulting low-molecular-weight polymer is called an *oligomer* (Greek *oligos*, “few”). The structural unit enclosed by brackets or parentheses is

## Basic Principles

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referred to as the *repeating unit* (or *monomeric unit*). One might reasonably argue that the first repeating unit shown previously is  $[-CH_2-]$  rather than  $[-CH_2CH_2-]$ ; however, it is more conventional to define repeating units in terms of monomer structure. The *smallest* possible repeating unit ( $[-CH_2-]$  in this instance) is referred to as the *base unit*.

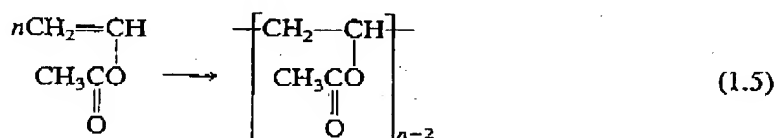
*End groups* are the structural units that terminate polymer chains. Where end groups are specified, they are shown outside the brackets, for example,



Some polymers are deliberately synthesized with reactive end groups for undergoing further reaction. Polymers containing reactive end groups are called *telechelic polymers* (from the Greek *tele*, far, and *chele*, claw). Related to telechelic polymers are the commercially important *reactive oligomers*, which are oligomers containing end groups capable of undergoing polymerization, usually by heating, to form network polymers.

Polymers formed by alkene addition reactions are called *homochain* polymers because the polymer chain, or *backbone*, as it is commonly called, consists of a single atom type—carbon—with other atoms or groups of atoms attached. *Heterochain* polymers such as polyethers or polyesters contain more than one atom type in the backbone.

The *degree of polymerization* (DP) refers to the total number of structural units, including end groups, and hence is related to both chain length and molecular weight. Consider, for example, the polymerization of vinyl acetate (an important industrial monomer) in reaction (1.5):



DP in this case is equivalent to  $n$  (note that two monomer units are at the chain ends), and the molecular weight of the macromolecule is the product of DP and the molecular weight of the structural unit. For a DP of 500, for example,

$$\text{Molecular weight} = 500 \times 86 = 43,000$$

Because polymer chains within a given polymer sample are almost always of varying lengths (except for certain natural polymers like proteins), we normally refer to the *average degree of polymerization* (DP).

A polymer prepared from a single monomer is called a *homopolymer*. If two or more monomers are employed, the product is a *copolymer*. In copolymers the monomeric units may be distributed randomly (*random copolymer*), in alternating fashion (*alternating copolymer*), or in blocks (*block copolymer*). A *graft copolymer* consists of one polymer branching from the backbone of the other. These various possibilities are illustrated schematically in Figure 1.1 for hypothetical monomers A and B. There are different kinds of block copolymers. Where blocks of A and B alternate in the backbone, the polymer is designated an  $[-AB-]$  *multiblock* copolymer. If the backbone consists of a single block of each, it is an *AB diblock* copolymer. Other possibilities include ABA (*triblock*: a central B block with terminal A blocks) and ABC (*triblock*: one each of three different blocks). As will be seen later, certain monomer combinations display a tendency toward alternation during copolymerization, whereas formation of block and graft copolymers requires special techniques. Polyesters